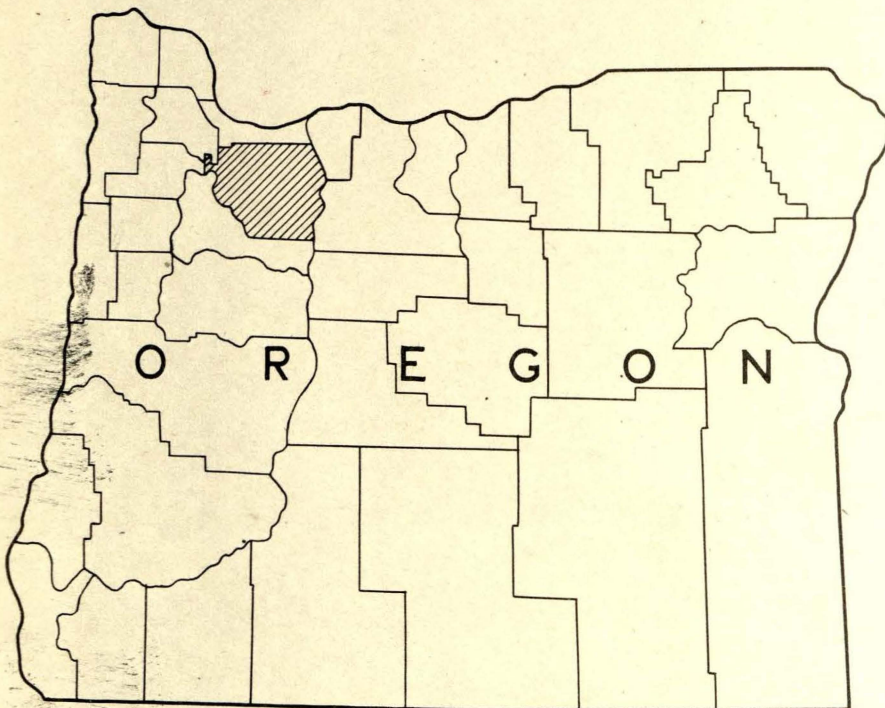


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FOREST STATISTICS FOR CLACKAMAS COUNTY, OREGON

FROM THE FOREST SURVEY INVENTORY REVISED IN 1944
FOREST SURVEY REPORT NO. 97



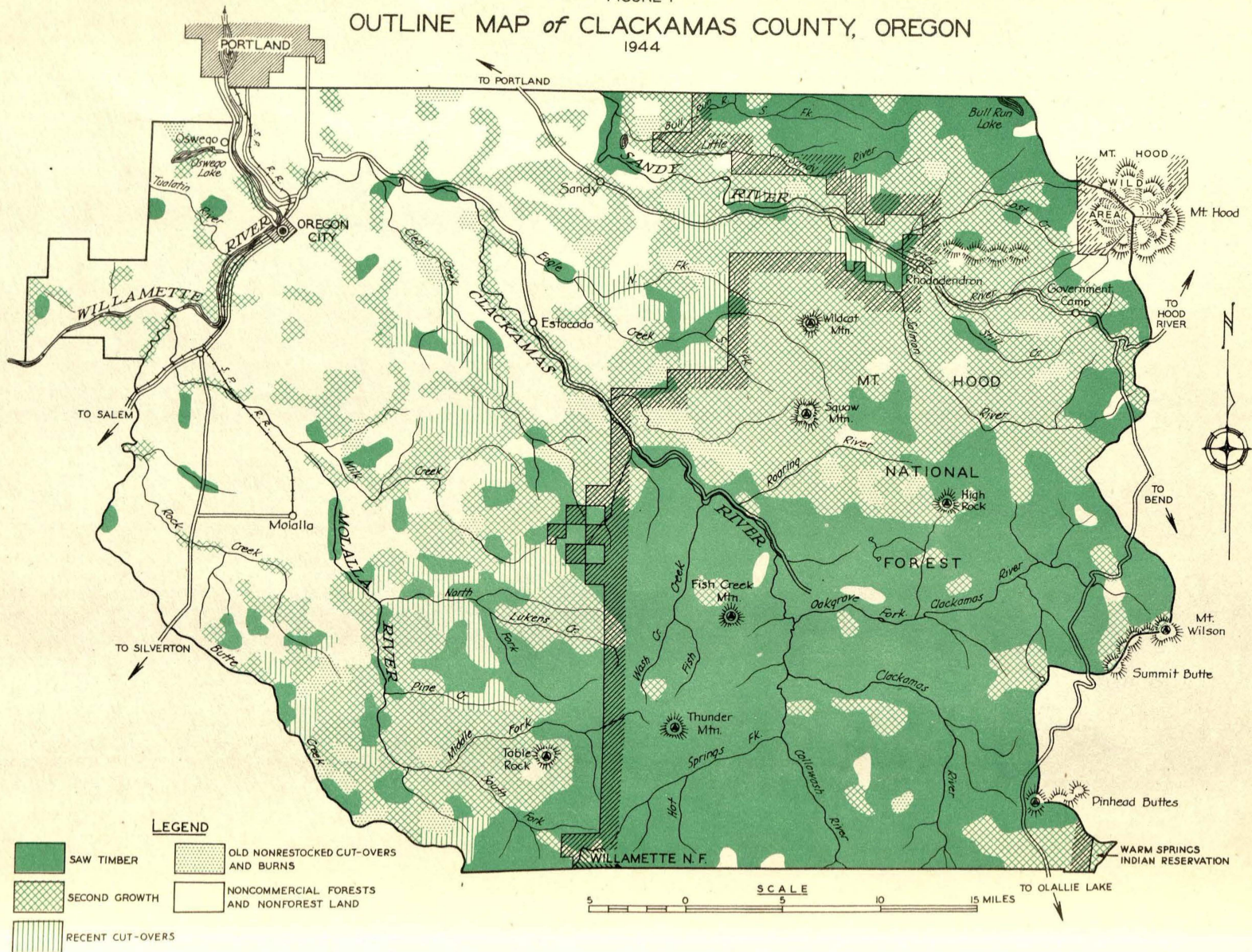
U. S. DEPARTMENT OF AGRICULTURE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
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R. W. COWLIN, IN CHARGE OF FOREST SURVEY
PORTLAND, OREGON

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APRIL 1946

FIGURE 1

OUTLINE MAP of CLACKAMAS COUNTY, OREGON 1944



FOREWORD

The forest survey, a Nation-wide project, consists of a detailed investigation in five major parts of present and future forest resources: (1) An inventory of the country's existing forest resources in terms of areas occupied by forest-cover types and of timber volumes, by species, in board feet and cubic feet, and a study of conditions on cut-over and on burned forest lands; (2) a study of the depletion of the forests through cutting and through loss from fire, insects, disease, and other causes; (3) a determination of the current and potential growth on forest areas; (4) an investigation of present and prospective requirements for forest products; and (5) an analysis and correlation with other economic data of findings of these studies in order to make available basic facts and guiding principles necessary to plan for sound management and use of forest resources.

The forest survey of Oregon and Washington, an activity of the Pacific Northwest Forest and Range Experiment Station, was conducted in the Douglas-fir region during the period 1930-33. 1/ In 1937, work of keeping the survey up to date was commenced in counties in which there had been a large amount of cutting depletion since the original survey.

The original forest inventory for Clackamas County, Oregon, was conducted in 1931 and 1932, and statistical summaries and a detailed forest type map were issued as of March 1, 1933. Field work for the reinventory of the county's forest was carried on during the summer and fall of 1944. Adjustments were made for changes resulting from logging, fire, restocking of cutovers and burns, and transfer of land ownership since the original survey. Revised statistics, as of October 1, 1944, are given in this report and prints of the revised county type map may be obtained. 2/

1/ Oregon and Washington were divided for survey purposes into two regions; (1) Douglas-fir region, consisting of that part of both States west of the Cascade Range summit, and (2) ponderosa pine region, that part of both States east of the Cascade Range summit. A regional report which includes an interpretation of the forest survey data and analysis of the forest situation has been published for each of the two regions.

2/ For information on the detailed 1-inch-to-the-mile forest type map of the county or the 1/4-inch-to-the-mile lithographed State type maps covering Oregon and Washington, address Director, Pacific Northwest Forest and Range Experiment Station, 423 U. S. Court House, Portland 5, Oregon.

Forest Statistics for Clackamas County, Oregon

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FOREST STATISTICS FOR CLACKAMAS COUNTY, OREGON

By G. S. Meagher^{1/}

Permanent closure of the two largest sawmills in the Portland industrial area, during the past 18 months, has focused attention on the growing scarcity of old-growth timber in northwest Oregon. Wood-using industries of the area are rapidly approaching the period when they must either pay high rates for hauling logs very long distances, or shift to a second-growth timber economy. Forest lands of Clackamas County are destined to play an important role during this transition period since they contain the only extensive old-growth stands within a fifty-mile radius of the City of Portland.

This report, based largely on results of the reinventory of 1944, has been prepared to furnish a general picture of the forest situation in Clackamas County including basic data on forest type areas, timber volumes, forest ownership, and current rates of forest depletion and forest growth.

Physical Character of the County

Clackamas County, with a total land area of 1,878 square miles ranks fifth in size among the counties of western Oregon. From the county's northwest corner, which adjoins the City of Portland, it extends some 30 miles south to the Willamette Valley, and 50 miles east to the crest of the Cascade Range (figure 1). Starting at an elevation of only 25 feet along the Willamette River, near Portland, the land rises to the eastward to heights of 4,000 and 6,000 feet. Snow-capped Mount Hood, at the northeast corner of the county reaches an elevation of 11,253 feet, the highest point in Oregon.

County boundaries enclose the main drainage basins of the Sandy, Clackamas, and Molalla Rivers which traverse the county in a northwesterly direction. Smaller areas near the county's west and southwest boundaries are drained by the Tualatin and Pudding Rivers. Except for the Sandy River which empties directly into the Columbia, all major streams are tributary to the Willamette River.

The western third of Clackamas County lies within the Willamette Valley and is a district of level valley lands intermingled with terraces and rolling uplands. To the east, the uplands merge gradually with the foothills of the Cascade Range, and the eastern half of the county, which lies within the Cascade Range proper, is decidedly rough and mountainous.

^{1/} Field work for the reinventory was by George E. Morrill, Loren Haneline, and G. S. Meagher; Inga E. Fulkerson, W. H. Schwindel and Lloyd A. Fullington performed a large part of the office computation.

In the valley and foothill zones a mild and humid climate prevails, with a yearly rainfall of about 45 inches and a frost-free period of around 200 days. In the mountain zone, precipitation increases to as much as 75 and 85 inches yearly, with a large part of the winter precipitation occurring as snow. Temperature fluctuations are likewise greater in the mountain zone and the frost-free period decreases to about 30 days along the summit of the Cascade Range. Climate in all parts of the county is characterized by a wet and dry season; 70 to 75 percent of the annual precipitation occurs during the winter (October through March).

Nonforest Land

In the 1944 survey, some 265,000 acres, representing 22 percent of the total land area, was classified as nonforest lands (table 1). Almost 247,000 acres was found to be in agricultural use (type 3) and an additional 18,000 acres was classed as "other" nonforest land (type 2).

Crop and pasture lands cover broad areas in the valley portion of the county, with livestock production, dairying, and poultry raising the principal agricultural activities. Most of the lands adapted to agricultural use have been in farms for a long period of years, and opportunities for further expansion are limited.

Cities, towns, and suburban areas along the Willamette River account for about half of the "other" nonforest land acreage. With water, rail, highway transportation, and hydroelectric power, all readily available, this area has long been an important industrial and manufacturing district. Oregon City, with a population numbering 6,124 in 1940, is the largest city and the county seat.

The remainder of the "other" nonforest acreage is comprised of the large barren areas found above timberline on the slopes of Mount Hood, the scattered mountain meadows, and the small areas of unmeandered water surface. Most of the mountain meadows are used as summer pasture for cattle or sheep and the timberline and adjacent areas on Mount Hood are intensively developed for recreational use, both summer and winter.

Noncommercial Forest Land

Forest lands that are not capable of producing timber crops of commercial size and quality aggregate about 16,000 acres (table 1). In Clackamas County three forest types were included in this category.

Forest lands within the altitudinal range of commercial timber that were found to be too steep, too rough, or too sterile to produce a commercial stand were classed as noncommercial rocky areas (type 38).

Table 1.--Area of commercial and noncommercial forest land and nonforest land, by ownership and cover type, as of October 1, 1944

(Acres)

Type No.	Cover type	Total	Unreserved							Reserved ^{1/}				
			Total	Private	State	County	Indian	Federal Revested land grant	Public domain	National forest	Total	State	Municipal	Federal National forest
All lands														
	Forest land	937,150	933,335	310,470	7,270	11,000	675	55,770	12,405	535,745	3,815	120	3,070	625
	Nonforest land	264,810	260,445	254,215	465	380	20	415		4,950	4,365		35	4,330
	Total	1,201,960	1,193,780	564,685	7,735	11,380	695	56,185	12,405	540,695	8,180	120	3,105	4,955
Commercial forest land														
6	Douglas-fir													
	Large old growth	51,530	50,825	16,770	430	35		2,605	320	30,665	705		705	
7	Small old growth	175,320	175,030	15,970		300		2,710	25	156,025	290			290
8	Large second growth	53,505	53,340	36,675	150	765		4,305	570	10,875	165	65		100
9	Small second growth	241,305	240,230	126,405	405	4,585		24,625	10,080	74,190	1,015			1,015
10	Seedlings and saplings	96,935	96,800	44,305	2,250	2,325		6,365	485	41,070	135			135
	Western hemlock													
14	Large	70,020	69,770	2,495		15		475	70	66,715	250			250
15	Small	4,945	4,915	1,895		35		95		2,890	30			30
16	Seedlings and saplings	720	720	360				50		310				
	Western redcedar													
17	Large	2,020	2,020	15		55		20		1,930				
19	Small	440	440	170				200		70				
	Fir-mountain hemlock													
23	Large	73,645	73,620	3,320				945	10	69,345	25			25
24	Small	47,425	47,410	1,955		340	60	2,725	705	41,525	15		15	
	Lodgepole pine													
25	Large	895	895							895				
26	Small	13,770	13,770	130		510				13,130				
	White fir-larch-Douglas-fir													
27	Large	945	945							945				
28	Small	65	65							65				
	Hardwood													
31.5	Large	3,015	2,960	2,455		65		215		225	55	55		
31	Small	5,650	5,405	4,055	5	140		295	20	690	245		245	
	Nonrestocked cutover													
35	Cut prior to 1920	2,550	2,345	2,330		15					205		205	
35A	Cut from 1920-29, incl.	7,295	7,295	3,075	1,315	205		1,375		1,325				
36	Recent cutover, since 1930	49,610	49,530	38,435	2,645	1,150		6,270	20	1,010	80		80	
37	Deforested burn	19,185	19,185	9,035	70	820	105	1,910	55	7,190				
	Total	920,790	917,575	309,850	7,270	10,850	675	55,185	12,360	521,385	3,215	120	3,070	25
Noncommercial forest land														
4	Woodland (oak-madrone)	490	490	490										
33	Subalpine	2,675	2,075							2,075	600			600
38	Noncommercial rocky area	13,195	13,195	130		150		585	45	12,285				
	Total	16,360	15,760	620		150		585	45	14,360	600			600
Nonforest land														
3	In agricultural use	246,630	246,595	245,450	465	380		300			35		35	
2	Other	18,180	13,850	8,765			20	115		4,950	4,330			4,330
	Total	264,810	260,445	254,215	465	380	20	415		4,950	4,365		35	4,330

^{1/} Cutting for commodity production prohibited by Federal, State, or municipal regulation or legislation. Reserved for watershed protection or recreational use.

This type is confined to the mountainous portion of the county, where it includes most of the rocky ridge tops, rock slides, and cliffs. Total type area amounts to slightly more than 13,000 acres.

Subalpine stands (type 33), which cover almost 3,000 acres, are found just below timberline on the slopes of Mount Hood. They consist largely of stunted, open park-like stands of alpine fir and mountain hemlock.

Subalpine and rocky noncommercial types are both of negligible timber value but add substantially to the watershed and recreational assets of the county.

Also included in the noncommercial category, is 490 acres of oak woodland (type 4). Of limited extent on the dry sites of the valley zone, this type furnishes a small volume of fuelwood.

Commercial Forest Land

Commercial forest types, which cover almost 921,000 acres, account for 98 percent of the forest land or 77 percent of the total land area. They blanket practically all of the mountain and foothill zones and occur as scattered woodlands throughout the valley district.

In every respect, Douglas-fir is the number one tree species of the county; it predominates on 67 percent of the commercial forest area and comprises 59 percent of the saw-timber volume and 80 percent of the sawlog production. Western hemlock, western redcedar, and grand fir are often found in mixture with Douglas-fir at low and intermediate elevations; western hemlock, western white pine, noble fir, and Pacific silver fir are the more common associates as the upper altitudinal limits of Douglas-fir are approached. Between elevations of 3,500 and 4,000 feet, Douglas-fir types gradually give way to upper-slope mixtures in which mountain hemlock or one of the balsam firs is in the majority. Western larch, Alaska yellow-cedar, and Engelmann spruce are also of limited occurrence in the upper-slope types. Although conditions of climate and soil generally favor the conifer species, hardwoods frequently form an understory in old-growth stands and occasionally form almost pure hardwood types on particularly moist sites.

The commercial forest land contains 22 individual forest types, segregated on the basis of species composition, tree size, and stand condition. Statistics on the area of each type, by ownership class are given in table 1, and a more generalized grouping of the commercial forest types is presented in table 2.

Table 2.--Area of commercial forest land, by ownership and generalized forest type, as of October 1, 1944

(Acres)

Generalized forest type	Total	Unreserved								Reserved ^{1/}			
		Total	Private	State	County	Indian	Federal			Total	State	Municipal	Federal National forest
							Revested land grant	Public domain	National forest				
Conifer saw timber Types 6, 7, 8, 14, 17, 23, 25, and 27	427,880	426,445	75,245	580	1,170		11,060	995	337,395	1,435	65	1,345	25
Conifer second growth Types 9, 15, 19, 24, 26, and 28													
On cutovers	39,155	39,150	37,835	75	435		775		30	5		5	
On burns	238,710	237,670	92,130	330	4,275	460	25,810	10,555	104,110	1,040		1,040	
Total	277,865	276,820	129,965	405	4,710	460	26,585	10,555	104,140	1,045		1,045	
Conifer seedlings and saplings Types 10, 16, 19, 24, and 26													
On cutovers	34,295	34,160	24,645	2,195	1,100		3,375		2,845	135		135	
On burns	93,445	93,430	20,610	55	1,475	110	4,100	715	66,365	15		15	
Total	127,740	127,590	45,255	2,250	2,575	110	7,475	715	69,210	150		150	
Recent cut-over areas Type 36	49,610	49,530	38,435	2,645	1,150		6,270	20	1,010	80		80	
Nonrestocked cut-over and burned-over areas Types 35, 35A, and 37	29,030	28,825	14,440	1,385	1,040	105	3,285	55	8,515	205		205	
Hardwoods Types 31 and 31.5	8,665	8,365	6,510	5	205		510	20	1,115	300	55	245	
Total	920,790	917,575	309,850	7,270	10,850	675	55,185	12,360	521,385	3,215	120	3,070	25

^{1/} Cutting for commodity production prohibited by Federal, State, or municipal regulation or legislation. Reserved for watershed protection or recreational use.

In brief, 47 percent of the commercial forest land in Clackamas County supports stands of saw-timber size, 44 percent is occupied by immature second growth, 5 percent has been clear-cut since 1930, and 3 percent consists of burns and older cutovers that have failed to re-stock; only one percent supports stands predominately hardwood.

Conifer Saw Timber

In the survey, conifer types with the majority of their volume in trees larger than 20 inches $\frac{2}{2}$ d.b.h. and otherwise suitable for sawlogs, were classed as saw timber. The most extensive area of conifer saw timber covers some 410 square miles in the southeast corner of the county; it extends almost unbroken from the upper reaches of the Molalla River east to the summit of the Cascade Range. A second sizable block is found near the north boundary of the county in the upper watershed of the Bull Run River.

Large old-growth Douglas-fir (type 6) was never as widespread in Clackamas County as in other portions of northwest Oregon. The largest type area, of about 10,000 acres, is found in the Bull Run River drainage. Two other sizable blocks occur near the headwaters of the Middle and South Forks of the Molalla River. In the main watershed of the Clackamas River, Douglas-fir stands of this size class are of limited extent, usually covering relatively small areas along the stream courses. Altogether, type 6 stands cover 51,000 acres and account for one-eighth of the saw-timber area. Ages vary from 300 to 400 years, and loss from cull and breakage is fairly high, averaging as much as 35 or 45 percent of the gross volume over large areas.

From the standpoint of both type area and volume, small old-growth Douglas-fir (type 7) is the most important saw-timber type in the county. It covers extensive areas in almost all parts of the upper Clackamas River basin and smaller tracts along the North Fork of the Molalla River. Type 7 stands in Clackamas County are, in general, a younger age class than the type 6 stands, averaging between 200 and 250 years. In the aggregate, they occupy 175,000 acres, or about two-fifths of the total saw-timber area. On the average, the timber is poorer in quality than that of the type 6 stands, but loss through cull and breakage is lower, averaging about 30 percent.

Douglas-fir stands of saw-timber size that are less than about 170 years old were classed as large second-growth Douglas-fir (type 8). They are widely scattered throughout the western third of the county, usually occurring as small tracts, intermingled with farms, cutovers, and immature conifer types. A larger type 8 area of almost 5,000 acres borders the upper Clackamas River near the southern boundary of the

$\frac{2}{2}$ 16 inches d.b.h. and larger for fir-mountain hemlock types, and 12 inches d.b.h. and larger for lodgepole pine types.

county. Timber of the type 8 stands is generally rough and coarse grained but defect due to decay is less a factor than in the old-growth stands. Ages vary from 50 to 160 years, but the majority are 80 years or older. Stocking conditions are fairly good, with one-third by area well stocked, one-half medium stocked, and one sixth poorly stocked (table 3). Type 8 stands cover a total of 53,000 acres, an area slightly larger than that occupied by type 6 stands.

Saw-timber stands in which western hemlock comprises a majority of the volume (type 14) are fairly extensive in the eastern half of Clackamas County. They are most common near the upper altitudinal limits of Douglas-fir and often contain Douglas-fir, noble fir, Pacific silver fir, and western white pine in mixture. Quality of the timber is better than average for western hemlock of the Oregon Cascades. The largest type area of about 12,000 acres is found near the headwaters of the Oak Grove Fork of the Clackamas River. Altogether, type 14 stands cover about 70,000 acres, accounting for one-sixth of the total saw-timber area.

Saw timber stands in which a majority of the volume is mountain hemlock, noble fir, or Pacific silver fir, or any combination of these three species were classed as fir-mountain hemlock saw timber (type 23). Stands of this class are extensive in the mountainous portion of the county from an elevation of about 3,500 feet to the upper limits of commercial forest types. With a total area of slightly under 74,000 acres, fir-mountain hemlock stands occupy about one-sixth of the total saw-timber area.

Stands of saw-timber size that are dominated by western redcedar (type 17), lodgepole pine (type 25), or white fir-larch-Douglas-fir mixtures (type 27) are of relatively limited extent. The three types combined cover only 4,000 acres, or less than 1 percent of the saw-timber area.

Immature Conifers

Fires that swept over large portions of the north Oregon Cascades during the period of early settlement are largely responsible for the present abundance of immature conifer stands in Clackamas County. The largest concentration of second-growth conifers blankets a large area in the northeast quarter of the county, extending from the Little Sandy River on the north to Roaring River on the south and from the agricultural zone on the west to the summit of the Cascade Range on the east. A second large block borders the Molalla River in the southwest corner of the county. Smaller tracts are widely scattered throughout the agricultural zone. Of the unreserved area stocked with immature conifers, totalling 405,000 acres, two-thirds is covered with stands of pole size (6 inches d.b.h. and larger) and one-third is occupied by stands of seedling and sapling size (less than 6 inches d.b.h.). The two size classes are often intermingled in the same general area.

Table 3.--Area of immature commercial conifer types on unreserved and reserved lands,
by age class and degree of stocking, as of October 1, 1944 ^{1/}

(Acres)

Age class (years)	Degree of stocking	Total	Unreserved									Reserved ^{2/}					
			Total	10 Douglas-fir seedlings and saplings	9 Douglas-fir small second growth	8 Douglas-fir large second growth	16 Western hemlock seedlings and saplings	15 Western hemlock small second growth	19 Western redcedar second growth	24 Fir-mountain hemlock second growth	28 White fir-larch-Douglas-fir second growth	Total	10 Douglas-fir seedlings and saplings	9 Douglas-fir small second growth	8 Douglas-fir large second growth	15 Western hemlock small second growth	24 Fir-mountain hemlock second growth
Total all ages	Good	126,975	126,815	18,600	93,360	8,175	175	3,610	270	2,625		160		130		30	
	Medium	232,815	231,935	47,175	122,485	26,860	545	1,160		33,645	65	880		865			15
	Poor	85,550	85,230	31,025	24,445	18,305		145	170	11,440		320	135	20	165		
	Total	445,340	443,980	96,800	240,290	53,340	720	4,915	440	47,440	65	1,360	135	1,015	165	30	15
10	Good	5,260	5,260	4,990					270								
	Medium	16,235	16,235	16,150						85		135	135				
	Poor	18,510	18,375	15,380						2,995							
	Total	40,005	39,870	36,520					270	3,080		135	135				
20	Good	6,105	6,105	5,965			140										
	Medium	32,740	32,730	26,325	1,290		545			4,570		10		10			
	Poor	22,095	22,095	15,565	235					6,295							
	Total	60,940	60,930	47,855	1,525		685			10,865		10		10			
30	Good	23,165	23,065	6,315	15,440		35	280		1,025		100		100			
	Medium	46,755	46,735	4,415	30,375			170		11,775		20		5			15
	Poor	9,655	9,655	80	7,820			80		1,675							
	Total	79,575	79,455	10,810	53,605		35	530		14,475		120		105			15
40	Good	34,810	34,770	1,330	31,240			810		1,390		40		10		30	
	Medium	42,375	42,375	285	32,260			715		9,050	65						
	Poor	5,390	5,370		5,025				170	175		20		20			
	Total	82,575	82,515	1,615	68,525			1,525	170	10,615	65	60		30		30	
50	Good	11,250	11,230		11,075	100		55				20		20			
	Medium	29,435	29,435		27,725			25		5,685							
	Poor	4,565	4,565		4,320	245											
	Total	45,250	45,230		39,120	345		80		5,685		20		20			
60	Good	24,775	24,775		23,980	500		210		85							
	Medium	20,190	19,525		18,250	525				770		665		665			
	Poor	3,260	3,260		3,025	235											
	Total	48,225	47,560		45,235	1,260		210		855		665		665			
70	Good	10,950	10,950		9,135	1,390		425									
	Medium	23,570	23,385		15,350	6,715		170		1,150		185		185			
	Poor	6,095	6,095		2,485	3,610											
	Total	40,615	40,430		26,970	11,715		595		1,150		185		185			
80	Good	1,370	1,370		30			1,215		125							
	Medium	8,625	8,625		365	8,195				65							
	Poor	6,090	6,090		365	5,725											
	Total	16,085	16,085		760	13,920		1,215		190							
90	Good	3,810	3,810		2,285	910		615									
	Medium	6,090	6,090		765	5,245		80									
	Poor	1,935	1,935		990	880		65									
	Total	11,835	11,835		4,040	7,035		760									
100 to 160	Good	5,480	5,480		205	5,275				495							
	Medium	6,800	6,800		125	6,180											
	Poor	7,955	7,790		180	7,610						165			165		
	Total	20,235	20,070		510	19,065				495		165			165		

^{1/} Excluding lodgepole pine (type 26).

^{2/} Cutting for commodity production prohibited by Federal, State, or municipal regulation or legislation. Reserved for watershed protection or recreational use.

Conifer stands of pole-size vary in age from 20 to 100 years, with a preponderance in the 30- to 70-year age classes. On eighty-seven percent of the pole-timber area Douglas-fir is dominant (type 9), 2 percent is dominated by western hemlock (type 15), 7 percent by fir-mountain hemlock mixtures (type 24), and 4 percent by lodgepole pine (type 26). Tree density is fairly high, with about one-third of the area well stocked, one-half medium stocked, and one-sixth poorly stocked. As shown in table 2, the stands on 85 percent of the area have come in on lands denuded by fire; the remainder of the area is restocked cut-over land.

Conifers of seedling or sapling size are in the 10- to 40-year age classes, the majority in the 20-year class. On about three-fourths of the total area of 128,000 acres of these stands, Douglas-fir is dominant. On most of the remainder the stands are of fir-mountain hemlock mixtures. The area of stands in which either western hemlock, western redcedar, or lodgepole pine is dominant is small. Approximately one-fourth of the area occupied by seedling and sapling stands is restocked cut-over land; three-fourths is restocked burns. Tree density is, on the average, less satisfactory than that of the pole stands; by area only about one sixth is well stocked, one-half is medium stocked, and one-third is poorly stocked.

Hardwoods

Stands dominated by hardwood species are confined to the western half of the county, where they usually occur as narrow stringers bordering the creeks and rivers. Of a total area of almost 9,000 acres, approximately one-third supports stands 12 inches in diameter or larger and was classed as merchantable hardwood (type 31.5); two-thirds stocked with trees below merchantable size was classed as small hardwood (type 31). About 47 percent of the hardwood area is predominately red alder, 24 percent black cottonwood, 6 percent Oregon ash, and 1 percent Oregon maple; 22 percent contains various mixtures of these species.

Recent Cutovers

In the survey, areas clear cut since 1930, which aggregate about 50,000 acres, were classified as "recent cutovers" (type 36); due to the relatively short period that has elapsed since many of these areas were cut, no attempt was made to determine the status of restocking. The largest clear-cut areas are found in Molalla River drainage where large-scale logging operations have been cutting old-growth stands, largely type 6 and 7. Other sizable cut-over tracts occur in areas drained by Eagle Creek and Clear Creek, two tributaries of the Clackamas River, and along the middle reaches of the Sandy River. Many of the smaller operations in the valley and foothill districts have been located in second-growth stands, types 8 and 9. Individual "recent cutovers" vary in size from 40 to 5,000 acres.

In most cases, they should restock promptly if adequately protected from fire, since the majority are interspersed or surrounded by green timber and a source of seed.

In addition to the 50,000 acres that has been clear cut, approximately 21,000 acres of existing stands has been partially cut. Partial cutting or "selective logging" operations in old-growth stands have covered about 4,000 acres. The remaining 17,000 acres of residual stands is the result of piling, pole, tie-mill, or fuelwood operations in second-growth Douglas-fir (types 8 and 9). Intensity of cutting varies from a very light selection in which the crown canopy is little disturbed to a heavy culling over that leaves only the inferior and defective trees.

Deforested Lands

Burns and older cutovers that have failed to restock account for only 3 percent of the commercial forest land in Clackamas County.

Deforested burns (type 37), with a total area of 19,000 acres, make up the bulk of the deforested class. The largest concentration of nonrestocked burns occurs along the North Fork of the Clackamas River; other sizable areas are found in the drainages of Eagle Creek, Roaring River, and Butte Creek.

Older cutovers, that have failed to restock, were placed in one of two classes, depending upon the year they were cut. Those cut prior to 1920 were classed as type 35; those cut from 1920 through 1929 were classed as type 35A. Of the approximate total of 70,000 acres clear cut prior to 1920, only 2,500 acres remained nonrestocked in 1944. They consist of a number of small tracts in the agricultural zone. The largest, located near the Bull Run River, occupies less than 600 acres.

Of the 22,000 acres cut during the decade 1920-29, slightly over 7,000, or about a third, remained nonrestocked in 1944.

Productive Capacity

The relative productive capacity of "site quality" of the commercial conifer land was rated according to either the Douglas-fir or spruce-hemlock site classification and the resulting statistics are given in table 4.

Five site quality classes are recognized in each classification, varying from site class I, the most productive, to site class V, the least productive. In general, the most productive forest lands are the

Table 4.--Area of unreserved and reserved commercial conifer forest land by site quality class^{1/}, as of October 1, 1944

Kind of forest land and site quality class	Total		Unreserved		Reserved ^{2/}	
	Acres	Percent	Acres	Percent	Acres	Percent
<u>All sites</u>						
Douglas-fir	695,135	76.2	692,430	76.2	2,705	92.8
Spruce hemlock	202,325	22.2	202,115	22.2	210	7.2
Lodgepole pine	14,665	1.6	14,665	1.6		
Total	912,125	100.0	909,210	100.0	2,915	100.0
<u>Douglas-fir site</u>						
Site class I	695	0.1	340	0.1	355	13.1
Site class II	96,000	13.8	94,540	13.6	1,460	54.0
Site class III	467,965	67.3	467,080	67.5	885	32.7
Site class IV	125,055	18.0	125,050	18.0	5	0.2
Site class V	5,420	0.8	5,420	0.8		
Total	695,135	100.0	692,430	100.0	2,705	100.0
<u>Spruce-hemlock site</u>						
Site class III	19,260	9.5	19,080	9.4	180	85.7
Site class IV	141,225	69.8	141,220	69.9	5	2.4
Site class V	41,840	20.7	41,815	20.7	25	11.9
Total	202,325	100.0	202,115	100.0	210	100.0
<u>Lodgepole pine site</u>						
Total	14,665	100.0	14,665	100.0		

^{1/} The "site quality" of a forest area is its relative productive capacity, determined by climatic, soil, topographic, and other factors. The index of site quality is the average height of the dominant stand at the age of 100 years. Five site quality classes are recognized for both Douglas-fir and spruce-hemlock types, class I being the highest. In the survey, the Douglas-fir classification was used for Douglas-fir, western redcedar, and white fir-larch-Douglas-fir types; the spruce-hemlock classification was used for the fir-mountain hemlock type as well as for the western hemlock type. No site classification is available for lodgepole pine stands.

^{2/} Cutting for commodity production prohibited by Federal, State, or municipal regulation or legislation. Reserved for watershed protection or recreational use.

bottomlands along the rivers and streams where deep, rich soils and abundant moisture occur. The lower and intermediate slopes and benchlands are usually of medium site; and the upper slopes and ridge tops, with shallow soils, rocky ledges, and a short growing season, are the least productive.

Of some 695,000 acres rated according to its ability to grow Douglas-fir, one-eighth was found to be site II, two thirds site III, and one-fifth site IV. Less than 1 percent, by area, qualified for site classes I and V.

The 202,000 acres, rated by the spruce-hemlock classification, includes the fir-mountain hemlock and other high altitude types which are generally less productive than the Douglas-fir. Only 10 percent by area qualified as site III, 70 percent was found to be site IV, and 20 percent rated as site V.

Since no suitable site classification has been prepared for lodgepole pine, the area occupied by this species is listed in table 4 merely as "lodgepole pine site."

Saw-Timber Volume

Total saw-timber volume in Clackamas County amounts to approximately 16.1 billion board feet, log scale, Scribner rule (table 5). According to 1943 estimates,^{3/} this comprises about 6 percent of the total saw-timber volume remaining in western Oregon.

Volume of Douglas-fir amounts to about 10.4 billion board feet, with 30 percent in large old-growth trees (larger than 40 inches d.b.h.), 51 percent in small old growth (22 to 40 inches d.b.h.), 11 percent in large second growth (22 to 40 inches d.b.h.), and 8 percent in small second growth (16 to 20 inches d.b.h.). Western hemlock volume aggregates 3.0 billion board feet, and the four balsam firs have a combined volume of 1.6 billion feet. The volume of the eleven other species found in the county totals 1.1 billion board feet, of which only 2 percent is contributed by hardwood species.

Forest Ownership

The forest ownership pattern in Clackamas County is fairly well defined. The total land area is divided into two almost equal segments by the boundary of the Mount Hood National Forest (figure 1). Forest lands located west of this boundary are largely in private ownership, while those lying to the east are practically all owned and administered by the Federal Government.

^{3/} Moravets, F. L. Saw-timber volume estimates for Oregon and Washington. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. June 1944. Processed.

Table 5.--Volume of timber by ownership and species, as of October 1, 1944

(Thousand board feet, log scale, Scribner rule)

Species	Total	Unreserved							Reserved ¹			
		Total	Private	State	County	Federal			Total	State	Municipal	Federal National forest
						Revested land grant	Public domain	National forest				
All species												
Conifers	16,041,393	15,945,262	2,318,719	27,688	30,065	442,256	56,491	13,070,043	96,131	818	94,923	390
Hardwoods	24,270	23,973	17,522	18	210	886	18	5,319	297	278	19	
Total	16,065,663	15,969,235	2,336,241	27,706	30,275	443,142	56,509	13,075,362	96,428	1,096	94,942	390
Conifers (trees 16 inches d.b.h. and larger)												
Douglas-fir												
Large old growth	3,151,483	3,119,200	594,733	13,132	2,762	115,703	7,455	2,385,415	32,283		32,276	7
Small old growth	5,288,230	5,266,712	440,699	4,611	5,157	103,300	3,361	4,709,584	21,518		21,496	22
Large second growth	1,110,590	1,107,173	459,152	2,648	8,405	55,547	8,580	572,841	3,417	573	2,843	1
Small second growth	882,733	871,812	349,420	2,580	10,161	90,322	33,539	385,790	10,921		10,920	1
Western hemlock												
Large	2,373,383	2,354,729	269,165	2,804	2,043	27,204	2,332	2,051,181	18,654		18,525	129
Small	645,347	640,507	89,507	701	623	7,170	597	541,909	4,840	164	4,644	32
Mountain hemlock	453,020	453,009	645			13	4	452,347	11		11	
Western redcedar												
Live	351,794	348,346	13,281		270	8,640	31	326,124	3,448	81	3,367	
Dead	1,666	1,666	50					1,616				
Western white pine	153,022	152,976	3,003	120	12	587	19	149,235	46		43	3
Lodgepole pine	4,762	4,762	93					4,669				
Pacific silver fir	488,592	487,807	2,655		385	219	288	484,260	785		655	130
Grand fir	35,886	35,886	2,147			95		33,644				
Noble fir	1,014,722	1,014,514	94,135	1,092	247	33,456	285	885,299	208		143	65
Alpine fir	32,764	32,764	22					32,742				
Western larch	28,987	28,987	12					28,975				
Alaska yellow-cedar	5,889	5,889						5,889				
Engelmann spruce	18,523	18,523						18,523				
Total	16,041,393	15,945,262	2,318,719	27,688	30,065	442,256	56,491	13,070,043	96,131	818	94,923	390
Hardwoods (trees 12 inches d.b.h. and larger)												
Red alder	9,745	9,654	6,663	2	173	434	2	2,380	91	87	4	
Bigleaf maple	6,215	6,025	2,710	15	37	309	15	2,939	190	175	15	
Black cottonwood	7,707	7,691	7,561			130			16	16		
Oregon ash	603	603	588	1		13	1					
Total	24,270	23,973	17,522	18	210	886	18	5,319	297	278	19	

¹ Cutting for commodity production prohibited by Federal, State, or municipal regulation or legislation. Reserved for watershed protection or recreational use.

In the survey, forest statistics were compiled for ten ownership classes, including four for Federal lands, two for State lands, and one each for private, county, Indian, and municipal ownerships.

Reserved Lands

Timber cutting on certain publicly owned forest lands is specifically prohibited by Federal, State, or municipal regulation or legislation. In Clackamas County, three ownership classes, with a combined forest land area of 3,800 acres fall into this category.

Forest lands owned by the City of Portland, and reserved for watershed protection purposes, cover slightly over 3,000 acres. These lands are all located in the Bull Run watershed near the northern boundary of the county.

A tract, near the Sandy River on the Mount Hood Loop Highway containing 120 acres of forest land, is held by the State of Oregon for highway park purposes.

The north and west slopes of Mount Hood are included in the Mount Hood Wild Area, which was set aside to preserve the scenic attractions of the area in their natural state. Although 5,000 acres of Clackamas County is enclosed by the boundaries of the area, only 25 acres support forest stands of commercial character.

Combined saw-timber volume of the reserved forest lands amounts to only 96 million board feet, a volume too small to be a significant factor in forest management activities in the county.

Unreserved Lands

Unreserved forest lands total slightly over 933,000 acres; they include over 99 percent of both the commercial forest area and the saw-timber volume.

National forest lands, in an unreserved status which aggregate 536,000 acres, constitute the largest single ownership class in the county. They contain about four-fifths of the saw-timber area and the saw-timber volume, two-fifths of the immature conifer area, one-third of the nonrestocked cutovers and burns, and seven-eighths of the noncommercial forest land. Only 5,000 acres of the national forest saw-timber area has been cut over to date. Productive capacity of the commercial conifer stands is considerably below that of the other unreserved ownership classes; while the average site quality for "other" lands averages slightly better than class III, commercial conifer lands of the national forests average about half way between classes III and IV. One small tract along the county's southern boundary drains into the Santiam River and is administered as part of the Willamette National Forest. The remainder of the national forest lands are included within the boundaries of the Mount Hood National Forest.

Privately owned forest lands total 310,000 acres, the second most extensive ownership class. Individual holdings are mostly small, varying from 10 to 500 acres. Many of the timbered tracts in and near the agricultural zone form integral parts of farm units; these farm woodlands, which are estimated to total 120,000 acres, represent an important part of the county's forest resource. Two large corporation holdings in the Molalla River drainage together cover around 60,000 acres. Privately owned forest lands contain one-sixth of the county's saw-timber area, one-seventh of the saw-timber volume, and two-fifths of the area of immature conifer. They also account for three-quarters of both the recent cutovers and hardwood stands and one-half of the nonrestocked cutovers and burns.

Third in extent among the ten ownership classes is the 55,000 acres of forest land administered by the Oregon and California Revested Land Grant Administration. Occurring in scattered tracts along the western boundary of the national forest, they contain about 11,000 acres of saw-timber stands, with a volume of 443 million board feet.

Forest lands in public domain status, which account for slightly more than 12,000 acres, are confined to five townships in the upper watershed of the Molalla River. A total of about 1,000 acres in this ownership supports stands of saw-timber size; most of the remainder is occupied by immature conifers.

Approximately 11,000 acres of forest land was found to be in county ownership in October 1944. Comprised of a large number of small tracts obtained through tax foreclosure, these lands are mostly cutovers, burns, or immature conifer. They usually remain in county ownership for a relatively short period since they are either sold at tax sales or deeded to the State of Oregon for state forests. State forest lands, very largely acquired from the county, now total about 7,000 acres and are chiefly concentrated in the Butte Creek drainage.

Tribal lands, of the Warm Springs Indian Reservation, include 675 acres of forest land in the extreme southeast corner of Clackamas County. Most of the tract is occupied by immature conifer stands.

Forest Growth

Current annual growth on the unreserved commercial forest land is estimated at 59.7 million board feet, or 42 million cubic feet (table 6). This represents the net increment on the 456,000 acres supporting immature stands (10 to 160 years old). On the 369,000 acres that contain older age classes, growth was assumed to be about equalled by mortality, windthrow, fungus, and insect losses. Also, no net growth is obtained on the remaining 93,000 acres, which include the recent cutovers, nonrestocked burns and older cutovers, and the lodgepole pine types. On the basis of both the cubic-foot and board-foot standards, Douglas-fir types are furnishing at least 90 percent of the current volume increment. Rate of forest growth may be expected to increase gradually as the old-growth timber is harvested and replaced by growing stands.

Table 6.--Current annual growth on the unreserved commercial forest land, by forest type group,^{1/} 1944

Type group	Area of growing stands (thousands of acres)	Current annual growth	
		Of trees 15.1 inches d.b.h. and larger (millions of board feet)	Of trees 5.1 inches d.b.h. and larger (millions of cubic feet)
Douglas-fir	390	55.7	37.6
Western hemlock	10	3.7	1.2
Other conifer types	48		2.9
Hardwood types	8	0.3	0.3
Total	456	59.7	42.0

^{1/} Lodgepole pine types omitted.

Potential annual growth was also estimated to furnish a measure of the growth that can eventually be reached if the unreserved commercial forest lands are all intensively managed on a sustained yield basis. Assuming that all conifer lands were occupied by growing stands (averaging 75 percent of full stocking), and with all ages up to rotation age equally represented, the annual growth rate could be boosted to about 256 million board feet (table 7). This estimate, which is based upon present utilization standards (tree 15.1 inches d.b.h. and larger), indicates that the conifer lands are capable of producing timber at a rate of **over four times** the current rate.

Table 7.--Potential annual growth on unreserved commercial conifer lands, by site group ^{1/}

Site group	Area (1,000 acres)	Potential annual growth		
		Of trees 15.1 inches d.b.h. and larger (millions of board feet)	Of trees 11.1 inches d.b.h. and larger (millions of board feet)	Of trees 5.1 inches d.b.h. and larger (millions of cubic feet)
Douglas-fir sites	693	203	321	68
Spruce-hemlock sites	202	53	75	16
Total	895	256	396	84

^{1/} Lodgepole pine sites omitted.

If the present trend toward more complete utilization continues, potential annual growth can be placed at 396 million board feet (trees 11.1 inches d.b.h. and larger) or 84 million cubic feet (trees 5.1 inches d.b.h. and larger). National forest lands account for about half of the timber growing capacity in the county.

Forest Depletion

Commercial logging operations, forest fires, and the cutting of minor forest products are responsible for the bulk of the depletion taking place in the forests of Clackamas County. Some losses continually result from the action of windthrow, disease, and insects, but these have remained normal in recent years and were allowed for in the growth estimates. Many of the small western white pines in the upper watershed of the Sandy River are infected with blister rust but losses in trees of saw-timber size have been negligible.

Records on annual sawlog production are available for the years 1925 through 1943 and are summarized in table 8. In comparison with other counties of the Douglas-fir region, sawlog production in Clackamas County has been maintained at a fairly steady level, averaging 158 million board feet, log scale, for the period. The lowest cut, 47 million board feet, is recorded for the depression year 1932, and the highest, 348 million board feet, was reached in 1942. During the 4-year period ending December 31, 1943, production averaged almost 300 million board feet yearly and will probably continue at about the same rate during the post-war period.

Table 8.--Average annual production of sawlogs
for specified periods, 1925-43

<u>Period</u>	<u>Thousand board feet,</u>
	<u>log scale</u> <u>Scribner rule</u>
1925 - 1929	132,549
1930 - 1934	100,752
1935 - 1939	129,670
1940 - 1943	299,629

In addition to the volume removed as sawlogs, a substantial volume is harvested annually in the form of piling, poles, posts, and pulpwood. Production of these minor products was estimated in 1930 to total 35 million board feet from trees of saw-timber size, in addition to 3.5 million cubic feet from smaller trees. While fuelwood production has probably decreased during recent years the cutting of poles and piling has been stimulated; current production of minor products is believed to average about 30 million board feet yearly.

In the 12-year period between inventories an average of 52 fires have burned over 1,500 acres of forest land yearly. Annual losses in merchantable timber types have been low, however, averaging about 250 acres with a saw-timber volume of 3 million board feet. As approximately one-half of the fire-killed timber has been salvaged, average annual fire depletion may be placed at about 1.5 million board feet. Current drain from fires, sawlog production, and the cutting of minor products is therefore estimated to be at the rate of about 332 million board feet per year.

Forest Industry

According to the 1940 census, 3,232 persons of a total labor force of 22,336 were engaged in the harvesting or manufacture of forest products. These figures rate forest industry as second only to agriculture as a basic source of income in the county. Two-fifths of the forest industry group is employed in the manufacture of pulp and paper, one-third is engaged in logging, and the remainder work in sawmills, planing mills, or other woodworking plants.

Reports from the State Forester's office show that 130 different companies or individuals harvested forest products in Clackamas County during 1944. Logging units vary in size all the way from large company operations that cut 50 to 90 million board feet a year and employ the most modern logging equipment, to seasonal operations where one individual using a team of horses produces a few second-growth sawlogs or piling from a few acres of farm woodland. Truck haul is used almost exclusively for transporting logs from the woods to towable waters. To facilitate truck transportation, one group of logging companies constructed a private logging road during 1944 that extends some 50 miles from the upper Molalla River to a log dump on the Willamette River near the town of Canby. This road, which will tap approximately a billion board feet of timber, eliminates difficulties imposed by state and county road regulation of truck traffic. It also permits employment of larger trucks, proper balance between truck size and load, and better time schedules.

The greater part of the volume of sawlogs produced in the county are exported, being towed in rafts down the Willamette River to mills located either at Portland or points on the lower Columbia River. Lumber production in the county consumes considerably less than one-half of the local log production. During the 19 years of record (1925-43), sawmills in the county have, on the average, cut 52 million board feet of lumber yearly. In 1944, the 47 active sawmills in the county produced about 83 million feet. Sawmills are small in size compared to the large plants located at Portland and other tidewater manufacturing centers in the Douglas-fir region. Only four have rated capacities, per 8-hour shift, of over 25,000 board feet.

The adjoining cities of Oregon City and West Linn have for many years been the principal center of pulp and paper manufacturing in Oregon. Their two large plants have a combined capacity of approximately 1,000 tons of wood pulp and 600 tons of paper per 24-hour day. They are the only pulp and paper mills in Oregon that produce large quantities of newsprint, and they provide a market for a large volume of hemlock, spruce, and grand fir logs cut in Clackamas and the neighboring counties. Currently, an expansion program is being carried out at the West Linn plant. This will add increased capacity for pulp and paper production and facilities for manufacture of machine-coated magazine paper. Improvements in the Oregon City plant will also increase capacity.

Comparison of Inventories

Some of the recent trends in forest type area, forest ownership, and saw-timber volume are apparent in the following tabulation, which compares some of the findings of the present survey with those obtained in the original inventory of 1933:

	<u>1933</u>	<u>1944</u>	<u>Change</u>
<u>Forest types</u> (in thousands of acres)			
Conifer saw timber	460	428	-32
Immature conifer	382	406	+24
Hardwoods	12	9	-3
Recent cutovers	22	49	+27
Nonrestocked cutovers and burns	66	29	-37
Noncommercial forests	<u>10</u>	<u>16</u>	<u>+6</u>
Total	952	937	-15
<u>Forest ownership</u> (in thousands of acres)			
Private	347	311	-36
Municipal	3	3	0
County	6	11	+5
State	0	7	+7
Public domain	12	12	0
Revested land grant	52	56	+4
National forest	<u>532</u>	<u>537</u>	<u>+5</u>
Total	952	937	-15
<u>Saw-timber volume</u> (in millions of board feet)			
Douglas-fir old growth	10,930	8,440	-2,490
Douglas-fir second growth	1,929	1,994	+65
Western hemlock	3,310	3,019	-291
Balsam firs	1,682	1,572	-110
Other conifers	998	1,018	+20
Hardwoods	<u>26</u>	<u>24</u>	<u>-2</u>
Total	18,875	16,067	-2,808

Changes during the 12-year period reflect a gradual reduction in the area of saw-timber stands, and a proportionate increase in the area occupied by immature conifers. It is encouraging to note that the area of burns and old cutovers that has failed to restock is now less than one-half the acreage reported for 1933. The increase in area of noncommercial forest types is due largely to a reclassification of certain areas near timberline and to the fact that noncommercial rocky areas were mapped in greater detail in 1944. Decrease in total forest land has resulted largely because the agricultural zone was covered by different survey techniques in the two inventories. In 1944, cover types of the agricultural zone were mapped in place with the aid of aerial photos, while in 1933 they were sampled with parallel strip surveys located at intervals of three miles.

Trends in forest ownership are fairly well defined and are characterized by a substantial decrease in privately owned forest land and an increase in all classes of public ownership except municipal and public domain.

Decrease in total saw-timber volume amounted to 2.8 billion board feet, with old-growth Douglas-fir contributing the major portion. Second-growth Douglas-fir and "other conifers" both showed a slight gain.

The Forest Situation Summarized

Forest lands of Clackamas County comprise a rich inheritance that has contributed substantially to past industrial development and expansion and one that promises to make an even greater contribution in coming years. Foremost among the county's forest resources are: 428,000 acres of conifer saw timber; 405,000 acres of immature conifer, and a total saw-timber volume of 16.1 billion board feet, of which old-growth Douglas-fir comprises more than half.

Timber depletion, resulting from logging, forest fires, and the cutting of minor forest products is currently at the rate of about 332 million board feet per year. This drain is partially offset by the increment on some 456,000 acres of growing stands, which are adding approximately 60 million board feet annually to the county's saw-timber volume. The fact that current timber depletion greatly exceeds the present rate of forest growth is not too alarming, since a large acreage in the county is occupied by old-growth stands that are in a more or less static condition. Potential growth estimates indicate that the 895,000 acres of unreserved commercial conifer lands, other than that occupied by lodgepole pine, are capable under intensive management of eventually producing about 256 million board feet per year on a basis of trees 15.1 inches d.b.h. and larger, and 396 million board feet on a basis of trees 11.1 inches d.b.h. and larger.

The annual cut from the forests of the county allowable under sustained yield management is calculated at about 350 million board feet. This calculation is based on the assumption that the present mature

timber will be harvested during a 100-year period and that the growing immature stands will be managed on about a 100-year rotation. Although such an allowable cut is slightly more than the current annual rate of depletion--332 million board feet--it is based on closer utilization of the immature stands in the future than is practiced at present and also on other phases of intensive forest practices which may not be attained on some of the forest lands.

Conditions in Clackamas County are generally favorable for the development of a permanent timber growing industry of large size. Nearly three-fourths of the unreserved commercial forest land is now in stable ownership and is being managed on a continuous production basis. Included are a number of the private holdings, the state forest lands, and the federal forest lands administered by the Forest Service and the O & C Administration. Also encouraging is the increased interest private timber companies are showing in keeping their cut-over lands productive, and in blocking up their holdings into sustained yield units. Forest practices on the 120,000 acres in farm woodlands can also be expected to improve. A technically trained forester is now assigned to Clackamas County, by the Forest Service, to assist farm woodland owners in all phases of the growing, harvesting, and marketing of forest crops.

On the liability side of the forest ledger may be listed the 29,000 acres of nonrestocked cutovers and burns and 56,000 acres of poorly stocked immature stands less than 50 years old. These lands are at present either nonproductive or producing at only a fraction of their capacity. The intensive forestry measures necessary for their early rehabilitation appear to be justified by their proximity to the wood-using industries of the lower Columbia River Basin.

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